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RESEARCH: HUMAN-NATURE CONNECTEDNESS AS LEVERAGE POINT

The voices of youth in envisioning positive futures for nature and people

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ABSTRACT

The unpredictable Anthropocene poses the challenge of imagining a radically different, equitable and sustainable world. Looking 100 years ahead is not easy, and especially as millennials, it appears quite bleak. This paper is the outcome of a visioning exercise carried out in a 2-day workshop, attended by 33 young early career professionals under the auspices of IPBES. The process used Nature Futures Framework in an adapted visioning method from the Seeds of Good Anthropocene project. Four groups envisioned more desirable future worlds; where humanity has organised itself, the economy, politics and technology, to achieve improved nature-human well-being. The four visions had differing conceptualisations of this future. However, there were interesting commonalities in their leverage points for transformative change, including an emphasis on community, fundamentally different economic systems based on sharing and technological solutions to foster sustainability and human-nature connectedness. Debates included questioning the possibility of maintaining local biocultural diversity with increased connectivity globally and the prominence of technology for sustainability outcomes. These visions are the first step towards a wider galvanisation of youth visions for a brighter future, which is often missing in the arena where it can be taken seriously, to trigger more transformative pathways towards meeting global goals

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1. Introduction

If you asked the average citizen 100 years ago what they imagined the world would look like in 2020, it is unlikely they would have predicted a global population of 7.7 billion with access to 2.71 billion smartphones, virtual reality and artificial hearts. Nor would they had imagined that, with these great feats, humanity has also managed to put one million species at risk of extinction, and continues to deplete natural resources in the name of economic growth. Even just going back a year -to early 2019- it would have been difficult to think of the world brought to its knees by an unseen enemy- the COVID-19 virus, despite our knowledge of previous pandemics.

We are now in the age of the Anthropocene, where human activity is the prime force driving unprecedented environmental change (Steffen et al. 2018) and the recent COVID-19 pandemic further emphasises some important messages for humanity. First, business as usual is no longer an option for a thriving planet and people (Settele et al. 2020). Second, transformative change is now even more urgently required for transitioning to a sustainable and safer future in an increasingly uncertain Anthropocene (Díaz et al. 2019; IPBES 2019a; Settele et al. 2020). There is another lesson to learn - as humans, we are pressed to imagine what better futures are possible and how we can act to get there (Hulme 2020; Pereira et al., 2019c). A recent assessment by the World Labour Organisation worryingly reports that over a half of the young people (15–29 years old) in developed countries and approximately a third in emerging and developing countries are fearful or uncertain of their future working life (ILO 2017).Therefore, it is paramount to engage the youth and early career researchers in sustainability initiatives to help address intergenerational problems with fresher views on the future (Lim et al. 2017; Jørgensen et al. 2019).

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Supplemental data for this article can be accessed here.

In sustainability science, transformative change refers to large, often long-term systemic changes of social-ecological systems (Meadows 1999; Westley and McGowan 2017). Visioning exercises contribute to generating desired social change for innovative interventions to flourish into transformative changes (Totin et al. 2018). Contrary to scenarios that focus on plausible future states, visions specifically focus on desirable future states, thereby,providing an inspiring narrative on which to galvanise action (Wiek and Iwaniec 2014). However, there is currently a substantial gap in existing futures literature relating to the plurality of desirable futures for humanity and how to reach them (Bennett et al. 2016). Increasingly, sustainability researchers are employing visions generated through participatory scenario processes (PSP) to promote collective action for transitions toward desirable futures (Oteros-Rozas et al. 2015; Lundquist et al. 2017; Hamann et al. 2020). The participatory process of visioning also generates futures literacy among the participants through whom it can lead to change in value systems, and can inspire people to make radical shifts in behaviour (Wiek and Iwaniec 2014; Bennett et al. 2016; Pereira et al. 2018). Analysis and comparison of different possible futures in the process of generating visions allows for the identification of 'leverage points'. These are places in complex systems where a small shift may lead to fundamental changes in the system as a whole (Meadows 1999). According to the level of influence on system behaviour, leverage points range from 'shallow' - interventions relatively easy to implement that represent little change to the overall functioning of the system - to 'deep' complex interventions that could result in transformative change (Abson et al., 2017; Meadows 1999). Transformative change is arguably going to occur from engaging and enabling systemic change through deeper leverage points, but the mechanisms for this are often much more difficult to develop and foresee.

There are currently few futures-orientated approaches that include diverse perspectives and values (Sharpe et al. 2016) and even fewer that involve youth (Nilsson et al. 2019). Younger generations are also still insufficiently integrated into science-policy and decision-making arenas in general (Lim et al. 2017). Engaging young people in these exercises gives them the opportunity to become invested in shaping their societies' futures and can help to elevate factors that youth consider pivotal and significant. Such initiatives that actively include youth in global sustainability decision-making and knowledge production processes increase the diversity of stakeholders and disciplines, which are crucial for these initiatives to be successful (Turnhout et al. 2012; Lim et al. 2017; Díaz-Reviriego et al. 2019).

In this paper, we document a visioning process with youth participants from around the world to help identify potential leverage points towards a more desirable future from their perspective. With support from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) capacity-building task force, a diverse group of youth interested in sustainability challenges was convened. This paper does not speak on behalf of all youth voices, but only of the participants represented at the workshop. However, it generally highlights the importance of providing a youth perspective that could contribute to driving major innovations towards sustainability (Jørgensen et al. 2019) as well as galvanise other initiatives that seek to engage youth voices and bring them into relevant environmental decision-making processes.

2. Rationale and methods

The visioning exercise was organized as part of the IPBES Youth workshop that took place in São Pedro, Brazil from 27 June to 28 June 2019 and was facilitated by IPBES experts and fellows of the Global Assessment, the Americas, and Europe and Central Asia regional assessments (IPBES 2019b). IPBES is an independent intergovernmental body of 134 member states that was established to strengthen the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development (https://ipbes.net/). To achieve its mandate, IPBES is undertaking assessments, catalysing knowledge generation, promoting the development of policy support tools and undertaking and facilitating capacity-building. The workshop was convened by the IPBES technical support unit on capacity-building. It was organized in collaboration with the IPBES scenarios and models expert group, the Norwegian Environment Agency, the Brazilian Platform on Biodiversity and Ecosystem Services (BPBES), the São Paulo Research Foundation's Research programme on Biodiversity, Characterisation, Conservation, Restoration and Sustainable Use (BIOTA-FAPESP), the International Institute for Sustainability (IIS), and the Inter-American Institute for Global Change Research (IAI).

The workshop contributed to the overarching objective of IPBES by expanding involvement in IPBES' efforts and increasing use of IPBES products among early-career scientists, decision- and policy-makers and practitioners, including representatives of different knowledge systems. This workshop was inspired by and had the same intention as the

IPBES Fellowship Programme, to build capacities of early-career individuals to enable and facilitate their participation in the work of IPBES. The IPBES Fellowship Programme brings early career professionals from around the world into the assessment process fostering the development of intergenerational, interdisciplinary and transnational partnerships, and creates an atmosphere that serves the larger goal of facilitating sustainability transformations by empowering and embracing diversity in skills, leadership styles, and values.

The workshop supported the implementation of the IPBES capacity-building rolling plan through promoting the fellowship programme and further expanding and supporting the development of communities of practice among early-career professionals inside and outside of the formal IPBES engagement. The specific objectives of the workshop were to: (1) Familiarize participants with the work of IPBES and explore how participants and their networks can contribute to its work programme; and (2) Explore positive futures of biodiversity and ecosystem services from the perspective of early-career professionals in order to contribute to IPBES' work on scenarios and models. It brought together 33 early-career professionals, with an average age of 29, from 23 countries, who work in the field of biodiversity and ecosystem services (Table 1). Selection of the participants was done by the IPBES technical support unit on capacity-building in collaboration with BPBES and IAI on the basis of nominations received from various governmental and non-governmental organizations and networks, with the aim to achieve geographical diversity, gender balance and representation of multiple knowledge systems. The participants of the workshop came from universities and research institutions, nongovernmental organizations, youth networks, as well as from organizations implementing policy and working in science-policy interfaces.

Table 1. Details of the workshop participants.

	Category	No. of participants
Nationality	Latin American and Caribbean Group (GRULAC)	18
	Africa	6
	Asia – Pacific	5
	Europe	4
Gender	Female	21
	Male	12
Sector	Education/Research	13
	NGO	7
	SPI	3
	Policy	3
	Research and SPI	2
	Research and Youth network	1
	NGO and SPI	2
	NGO and Youth Network	2
Broad expertise	Biodiversity Conservation	11
	Environmental Science and Engineering	7
	Agricultural Science	4
	Sustainable Development	4
	Environmental Policy and Governance	2
	Disaster Risk Reduction	1
	Geography	1
	Marine science	1
	Fisheries science	1
	Development studies	1
Knowledge fields	Natural Sciences and Engineering	29
	Social Sciences and Humanities	4
Knowledge systems participants work with	Scientific knowledge only	20
	Both Scientific, and Indigenous and Local Knowledge (ILK)	13

The visioning exercise focused on intentionally developing positive visions of nature from the perspective of the participants. Although there are limitations to only focusing on positive futures, there is plenty of scenarios work emphasising on undesirable futures (Meadow 1972; Slaughter 2004; Bennett et al. 2016; Riahi et al. 2017; Wyborn et al. 2021). Our aim was to explore the positive visions, and not be limited by current constraints and trajectories. This is in line with the workplan for IPBES scenarios and models task force that has positive nature futures at its core (Rosa et al. 2017). For the visioning process, we used the adapted Manoa mash-up method that had been developed in the Seeds of Good Anthropocene project (Pereira et al. 2018). The traditional Manoa scenario method generates exploratory scenarios that evolve from emerging issues or weak signals over several decades, to explore their long-range impacts and the possible outcomes of those impacts (Schultz 2015). This method is adapted in this paper by using seed initiatives instead of the weak signals as a starting point. 'Seeds' refer to existing initiatives that are not widespread or well-known; they can be social initiatives, new technologies, economic tools, social-ecological projects, or organizations, movements or new ways of acting that according to someone, have the potential to make a substantial contribution towards creating a future that is just, prosperous, and sustainable (Bennett et al. 2016). This approach has previously been employed in the development of positive nature visions by the IPBES task force on scenarios and models (Lundquist et al. 2017) and was the starting point of the Nature Futures Framework (NFF) that is used in this paper and will be described below (Pereira et al. 2020). Being a fairly new tool, the resulting NFF requires case studies to test its applicability in a variety of contexts and stakeholders in order (Pereira et al. 2020). The Brazil workshop was the first case study of the new Nature Futures framework being developed by the IPBES task force on scenarios and models. It served as a starting point for generating visions and its results will feed into ongoing work by the task force to further refine the framework and operationalise it globally. All workshop participants were invited to take part in writing this paper, of which 10 participants eventually co-authored it. All except one of

the authors identifies as a millennial- and so this is the predominant generational perspective in the paper.

2.1. Formation of groups through nature futures framework (NFF) triangle

The facilitators used the NFF triangle as a starting point for the visioning exercise(Figure 1; please see Pereira et al. 2020 for a full description of the framework). The NFF triangle explicitly recognizes that people consider multiple values of nature.

First, a triangle was drawn on the floor to represent the NFF triangle with the three vertices clearly marked on each corner to represent the different values of nature: 'Nature for Nature' which primarily emphasises the intrinsic value of nature, 'Nature for Society' which emphasises the instrumental value of nature and 'Nature as Culture', which emphasises the intertwined way people and nature connect (Pereira et al. 2020). Then, the participants were asked to reflect on 'why they value nature', thinking on a particular context and situation, and position themselves within the triangle on the basis of this preferred value. Next, the participants were asked to pair up with their closest neighbour in the triangle and discuss their respective examples and associated values of nature. The groups of two then merged into groups of four and similarly, discussed their respective values. Subsequently, they merged into three groups of eight and one group of nine (See Figure 1). This initial process had two aims: (1) to familiarize the participants with the NFF and to get them thinking about diverse values for nature and how they could be incorporated in a desirable future vision; and (2) to divide them into groups for the visioning exercise without pre-allocating them, asking them to choose a group or randomly selecting group members. The method increases the likelihood of affinity between group members in terms of how they perceive nature. By ensuring that the full space of the NFF had been covered by the 4 groups, we hoped that the resulting visions would at least have some diverse appreciation of nature values across groups, even if this was not made explicit in the instructions. Once clustered, each group was allocated a theme to focus their discussions: cities for Group (1); rural landscapes for both Group (2) and (3), and coastal ecosystems for Group (4). As will be made clear in the results, the groups found it difficult to stick to their allocated themes and so the resulting visions are more general in their scope. This will be further unpacked in the discussion.

2.2. Selection of seeds

The next task was for the groups to choose three seeds from which they would build their vision- one technological, one social or environmental and one economic or political (Table 2). It is important to note that setting up the visioning exercise around seeds with specific focus areas influences the prominence of related themes in the resulting visions (see Pereira et al. 2018 for more discussion on the choice of seeds). Alternative processes include pre-selecting seeds for the groups or not choosing the range of seed types (Pereira et al. 2019b). The facilitators wanted to leave some autonomy to the groups in being able to select seeds within the predefined seed types and elected to use this method, however we acknowledge that alternative methods would have resulted in different outcomes.

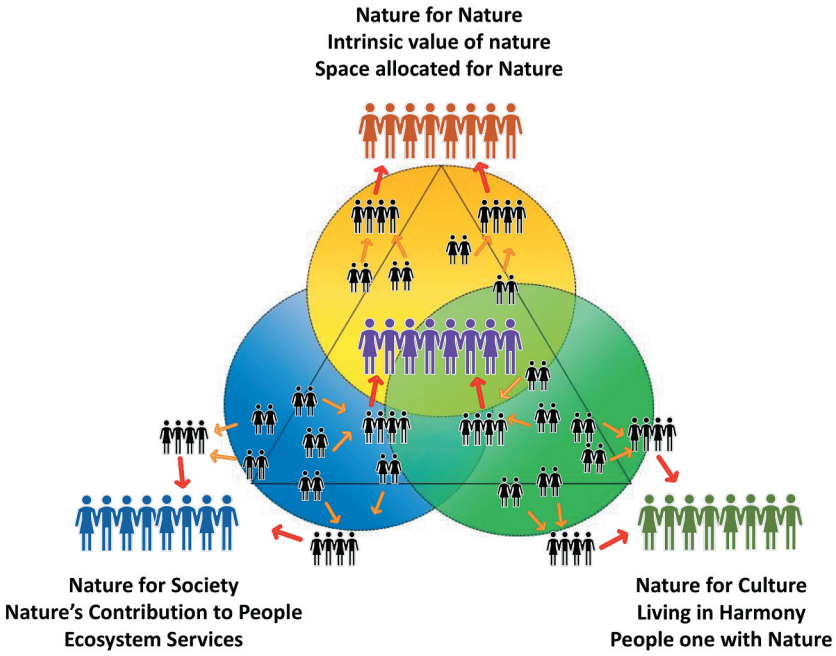

Figure 1. The Nature Futures Framework (NFF) triangle representing the three values of nature. This is purely for visualization of the process and the position of groups can change depending on the value preferred by the participants. In our study, we ended up with 3 groups of 8 and 1 group of 9 (Adapted from PBL, 2018).

Table 2. Brief description of the seed initiatives used for each vision as well as the classification of the seed using the leverage points framework (see Figure 2).

Vision	Theme	Seed name and type	Description	Leverage Point	Deep or Shallow
Anthropocene 2.0	Coastal ecosystems	Urban farming: *social/environmental*	Household and urban production of fruits and vegetables in urban gardens. The food will be shared within the community and there will be no food wastage.	10	Shallow
		Blockchain: *technological*	A system that allows consumers to track information regarding goods or services (CO_2 emission, single plastic use, ocean pollution, labour conditions, sustainable practices)	6	Deep
		Sharing economy: *economic/political*	Rather than individual materialistic ownership, goods and services are shared within the community. For example, clothes, cars and food.	2	Deep
Rural Transformers	Rural landscapes	Alt-meat: *social/technological*	Developing meat in laboratories and finding alternative protein sources to stop livestock rearing and ultimately, their negative impacts on the environment.	8	Shallow
		Plastic degrading bacteria: *economic/technological*	Using bacteria to degrade plastics to tackle solid waste management problem.	10	Shallow
		Drones for forest conservation: *environmental/technological*	Using drones to detect areas of priority for preservation in forest areas.	6	Deep
Econetlands	Cities	Agro-ecological communal farming: *social/environmental*	Ensuring sustainable production of food for all from agro-ecological communal lands.	7	Shallow
		Citizen science apps: *technological*	Citizen science and Apps for gathering data, monitoring and identification of flora and fauna.	6	Deep
		Gen Woke: *social/political*	Young people suing polluters in the name of intergenerational justice, which is growing in the climate movement.	3	Deep
Iandé Etama	Rural landscapes	International land planning: *political*	International land planning allowing effective use of productive landscape, protected areas and connective intermediary belts and buffers.	5	Deep
		Community 'power': *technological/environmental*	Universal, community-owned, renewable energy production.	5	Deep
		Land Sparing and Sharing: *social/political*	Land-sharing schemes in which community or privately-owned land can be pooled in order to gain access to government expertise, infrastructure and support, sharing the resulting increased profit.	4	Deep

Having chosen their seeds (see Table 2), the groups described what it would look like if each of the seeds were no longer marginal, but became the dominant way of doing things; these are defined as 'mature seeds'. For example, the widespread use of virtual platforms running on blockchain technology to track and exchange goods and services or formal legislative mechanisms helping people to hold decision-makers or companies accountable for their bad decisions to ensure intergenerational justice. Using these 'mature seeds', the groups built up the first, second and third- order social, technological, economic, environmental, political and value-based implications of these seeds in the future. Once a good spread of implications for each seed was discussed, the groups combined the three seeds by looking at similarities and key differences between the impacts (See Pereira et al. 2018 for a more detailed description of the approach).

2.3. Development of visions

Once a rough outline of visions was developed, each group came up with a name for their vision, a tweet, and a newspaper headline describing what the world would look like in their positive future (See Figure 3). All visions were graphically recorded by Design de Conversas.[1] On the second day of the visioning process, the groups were asked to answer the following questions to flesh out the skeleton visions (see Table S1 for answers):

- What do people look like?
- How do people consume things?
- What does 'nature' look like? How is it perceived?
- Who has a voice in the future?
- How do people spend their time?
- What do we do with waste?
- How does this vision compare to current 'desired' economic growth and development projections?
- What are the key feedbacks in this future?
- Are there important drivers in this future?
- What critical responses are needed to get to this future?
- What key innovations are important for this future?

The groups then presented their visions of these positive futures as a short play and concluded with a discussion session on the similarities and differences between the different visions, and other points of reflection.

2.4. Data analysis

The data for this paper are the responses from each group to the key questions (Table S1) and the description of their visions (Table 2). The visions

were analysed for commonalities and differences and then compared to existing scenarios archetypes that were used in the IPBES regional assessments (See Sitas et al. 2019). We used keywords or phrases as indicators to identify themes or points in common between the four groups and also discussed how the visions contribute to ongoing debates about pathways towards more desirable futures by referencing where they speak to existing recommendations (Table 3). Finally, following an iterative coding approach we classified the seeds according to the 12 places to intervene in a system framework (Meadows 1999) and further identified these as deep or shallow using the Leverage Points conceptual framework (Abson et al., 2017) (Figure 3; Table 2). One person coded the seeds, which was then verified by a second person and then agreed on by two more members of the group to ensure consistency. If there was any disagreement with a code, the second person then coded it again in discussion with the first coder and this was then assessed by a third member. This process went on until the codes were agreed by four coding members and then by the full author group.

3. Results

The four future worlds that arose during the visioning process were called Anthropocene 2.0, Rural Transformers, Econetlands and Iandé Etama and their starting seeds are described in Table 2 together with their codes. These codes correspond to the Meadows framework on where to intervene in a system (Figure 3).

Figure 2 also connects the NFF with the Leverage points framework by illustrating that it requires a bigger and broader triangle, i.e. a larger, more diverse set of values for nature to be able to open up more radical alternatives that can engage deeper leverage points around intent and design.

3.1. Description of visions

Each of the four visions had a different flavour of the types of better futures that may be able to unfold if we make better decisions in the present (Figure 3). These are elaborated in the following descriptions. Whilst reading these descriptions, it is interesting to bear in mind that having the NFF triangle as a starting point was intended to increase the likelihood of the visions to focus on specific perceptions of nature, and for the resulting visions to capture a range of value perspectives. Some correlation was observed, such as how the Econetlands vision- the only group who had participants from the Nature as Culture corner of the triangle- prominently captured aspects of traditional knowledge and indigenous ways of knowing. Similar themes were also reflected by Rural Transformers whose participants generally stood at Nature for Society corner. The Rural

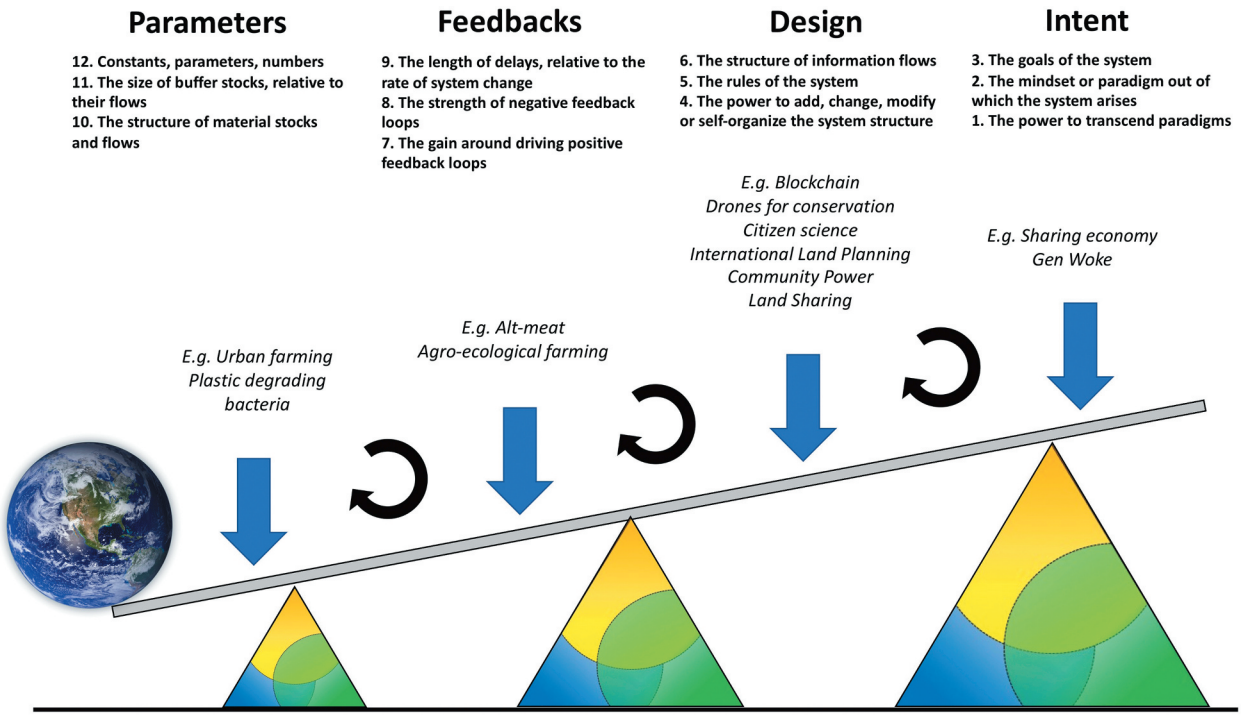

Figure 2. The leverage points framework presented here uses Meadows's 1999 "Places to Intervene in a System" to illustrate that shallow leverage points (7-12) are concerned with changing parameters and feedback in a system whereas the deeper leverage points (1-6) aim to change design and intent (See Abson et al., 2017). Examples of the seeds from the Youth workshop are mapped onto the figure. The NFF triangle can be seen as the pivot that can shift along the lever to open up more radical alternatives that can make it easier to find deep leverage points. The increasing size of triangles represents the increasing deepness of the leverage. (Figure adapted from Fischers & Riechers, 2019).

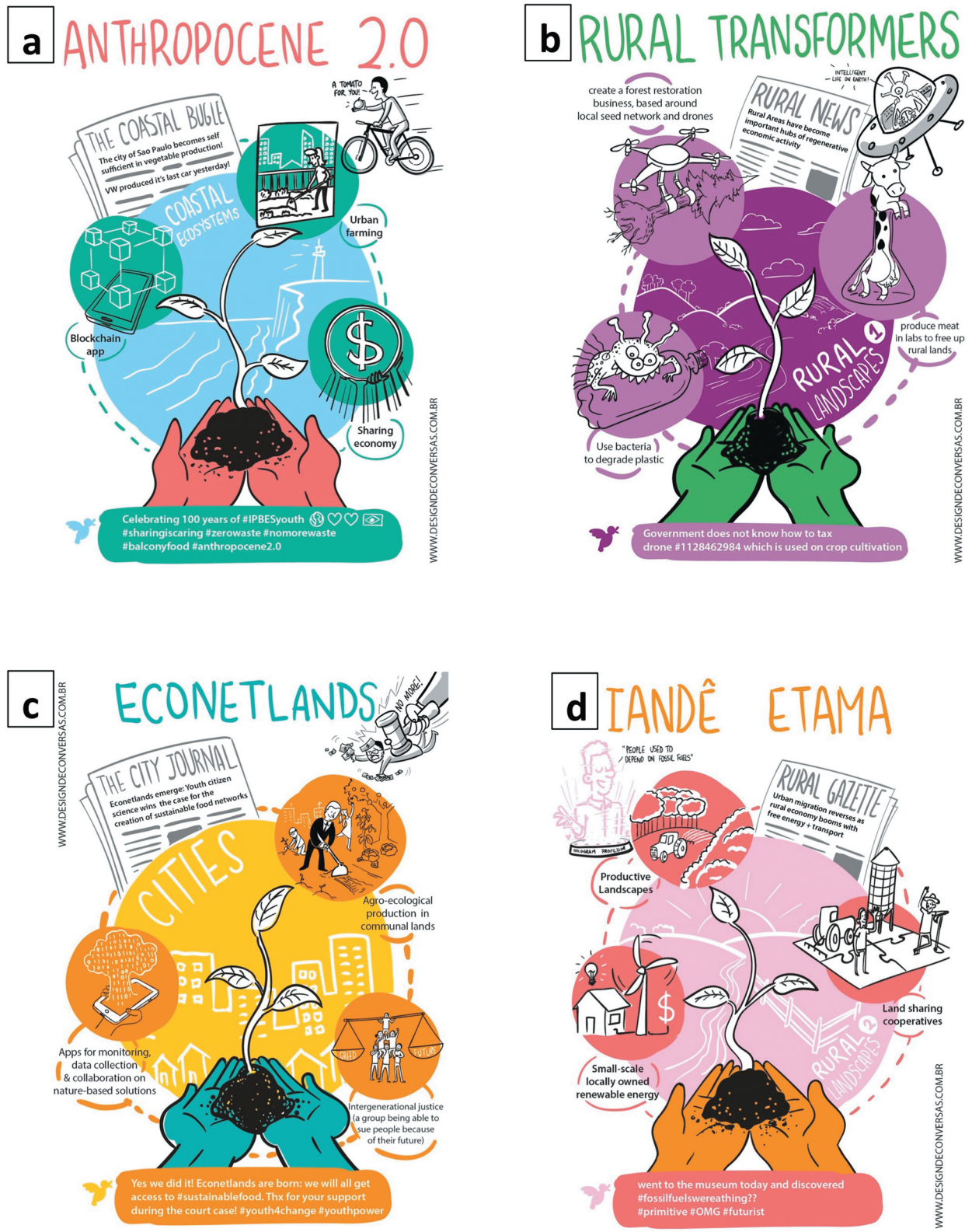

Figure 3. Graphical representation of the youth visions of positive nature futures a) Anthropocene 2.0; b) Rural transformers; c) Econetlands; and d) Iandé Etama. Each representation includes an image of each mature seed, the tweet and the newspaper headline describing what the world would look like in their positive future.

Transformers vision also included themes that suggest an instrumental value of nature for society – where people value and conserve nature for a sustained flow of ecosystem services. Iandé Etama, whose participants stood at the Nature for Nature corner was the only group to explicitly include aspects of protected areas, which are often established to conserve biodiversity for its intrinsic value.

Table 3. Summary of comparative analysis of the visions according to 18 identified general themes.

Themes	Anthropocene 2.0	Rural Transformers	Econetlands	Iandé Etama
Technology	Blockchain, virtual reality	AI and drones	Citizen science apps	Self-driving cars, robots
Production of food	Local production, equal access	Artificial meat	Local production, equal access	Areas specifically designated to growing and producing
Waste management	Recycled and reusable products, sharing and exchanging rather than buying	Bacteria for degrading plastics	Recycled and reusable products, sharing and exchanging rather than buying	Recycled and reusable products, sharing and exchanging rather than buying
Green technologies and Nature-based solutions	Renewable energy	Restoration strategies based on drones and AI, Energy from plastic degrading bacteria	Green energy and green infrastructure in cities	Renewable energy
Economy	Sharing economy	Regenerative economic activity	Circular economy	Sharing economy
Sustainable consumption	Responsible consumption. Sharing, exchanging or recycling rather than buying products	Responsible consumption	Responsible consumption. Sharing, exchanging or recycling rather than buying products	Responsible consumption. Sharing, exchanging or recycling rather than buying products
Agricultural activities	Household and urban production	Drones for sowing seeds	Agroecological communal farms	Agriculture more efficient supported by technology
Nature-society interaction	Closer connections between people and nature	Traditional knowledge is more valued. Closer connections between people and nature	Traditional knowledge is more valued. Closer connections between people and nature	Closer connections between people and nature
Participatory community development	Not considered	Communities are connected and value collaboration on nature-based solutions and promote restoration strategies	Agroecological communal farms, Participation of the most vulnerable and marginalised groups	Community cooperatives, Community-owned power grids
Social structure	Just and inclusive society	All are equal	Empowered and informed society. Fairness, equity, responsibility, accountability, and inclusivity are valued	Equal and empowered society
Education	Education supported by hi-tech tools	Accessible education	Not considered	Education supported by hi-tech tools
Conservation of biodiversity and ecosystems	Not considered	Restoration of degraded areas through AI-based drones.	Citizen science for mapping and monitoring biodiversity	Conservation of species and ecosystems at global and local scales by protecting spared lands
Human rights	Equal rights and non-discrimination	Not considered	Human rights to a clean and healthy environment of all, including future generations; enhanced participation of marginalised groups	Equal rights and non-discrimination
Land tenancy	Not considered	Not considered	Agroecological communal farms	Community or privately-owned land and community cooperatives
Governance	Not considered	Governance aimed at making people's lives better	Decentralized government. Empowered young people.	Good governance and land sharing policies
Human health	Fast, fatty, high sugar foods are obsolete.	People live a healthy life	Not considered	Not considered
Intangible Cultural Heritage	Not considered	Restoration of degraded land by traditional and indigenous people	Traditional knowledge and biocultural diversity are recognised and valued	Not considered
Urban and regional planning	Improved planning across jurisdictional levels	Not considered	Greener areas and more connected to surrounding rural landscapes	Areas designated for growing and producing a handful of products

3.1.1. Anthropocene 2.0 (coastal systems)

In this vision, transformative *behavior change*, in both individuals and society as a whole, was considered the key leverage point to sustaining nature in the long-term. People would value nature above their own materialistic goals, thereby rendering the need to measure success by GDP, or individual wealth useless. Instead, a happiness index would be the widespread metric used to measure success. It will be a world of sharing where individual materialistic ownership is non-existent.

All used goods and services are recirculated back into society; 'once worn' dresses are shared within their communities, as is transport - driverless cars and flying delivery vehiclesas well as shared bicycles and surfboards - because health and fitness are as important as ever in this future! *Renewable energy* is the only option, single-use plastic is no longer used, and all products are recyclable and reusable, meaning there is no need to continue mining for coal, oil and gas (although mining is still needed for other goods such as solar photovoltaic cells) and the ocean will be free of plastic.

Technology will become an even more fundamental part of decision-making processes in human societies as a key mechanism to meet human needs. Through virtual platforms run by blockchain technology, it will be possible to articulate and organize the exchange of goods and services in a *solidarity economy*, as well as transport, food and energy production. Whilst advanced education and specialist consultation could be provided to remote areas via virtual reality, people will still appreciate human-to-human connections. Technology supports a highly efficient economy, freeing up significant time for leisure activities, giving people the opportunity to cultivate art, culture, personal health, as well as their interpersonal and environmental relationships. People are able to spend greater amounts of time in the coastal ecosystems surrounding their city; walking on the coast and diving in the ocean to enjoy the biodiversity. This will, in turn, lead to a greater human-nature connection.

Household and urban production of fruits and vegetables is the norm, with healthy products delivered to your door from urban green gardens. Fast, fatty, high sugar foods are obsolete, as is obesity. The value of '*sharing is caring*' means there is zero hunger; everyone has access to safe, affordable and nutritious food, with clean water. Food wastage is a thing of the past, with more efficient and sustainable food and fibre production.

Greater accessibility and equality will be achieved by optimizing production and consumption in cities, both of food and goods, and improved planning across jurisdictional levels. This equal and sustainable, 'no person is left behind' utopian world is a possibility because environmental and human needs are put before individual greed. It was recognized that this positive and ambitious vision will need to be complemented with innovative strategies and practical actions as well as a stable population in order to ensure that everyone does indeed have equal access to all of nature's benefits.

3.1.2. Rural transformers (rural landscapes)

The rural landscapes of the future world were imagined as a new age where rural areas are hubs of *regenerative economic activity* and value matters more than money. The laws and dynamics of human societies are more integrated with ecosystem processes. With better and widely accessible education, people also have a greater awareness. People make a conscious choice of using only sustainable options. *Science and technology* have played a big role in this vision. Revolutionary innovations like lab-grown meat and plastic-eating bacteria have helped in achieving a greener world. As meat is produced in laboratories in this world, people no longer prefer keeping livestock. This lab-grown meat is now the main source of protein for people. This has helped in stopping deforestation, associated waste production, greenhouse gas emissions and other negative impacts which are driven by livestock rearing. The meat meets all food safety standards, which makes it a safer and sustainable alternative, and hence preferable. However, it also means that there are no longer livelihoods associated with the rearing of livestock.

Using artificial intelligence (AI) and drones, degraded areas were identified and prioritized for restoration by spreading native tree species seeds. The restored forests have helped in achieving greater biodiversity and also led to better provision of ecosystem services. This requires working closely with the local communities, especially traditional and indigenous people who have immense knowledge about these native trees and through whom the seeds are collected and fostered. This helped the communities to value their connection with nature and knowledge of it, and feel a sense of stewardship and hopefulness for nature. The drones are also used in farming. Farmers can mix the seeds and sow using these drones; taking away the drudgery of non-mechanised agriculture. Technology, in general, has helped them to save a lot of time and effort, which has led to a boost in sustainable agriculture production.

Lab-modified plastic-eating bacteria have dramatically led to a reduction in the more persistent and difficult to degrade non-biodegradable component of solid waste. There is a reduction in pollution due to less solid waste, pollution has reduced. Also, these plastic-eating bacteria are the primary source of clean energy in this world.

People-nature relationships have also greatly improved as a result. People see nature as the ultimate system that they are part of. The value of land has also changed in this world: land with high levels of

biodiversity is valued more than other areas. This also gives people a reason to be happy as they feel that they are not destroying the planet, and thus have a healthy life and a balanced environment to live in. The government also understands its people and their needs, respects their rights, and makes efforts to improve their lives.

3.1.3. Econetlands (cities)

This vision is rooted in a shift in societal values where people value *fairness, equity, responsibility, accountability*, and *inclusivity*, which we believe are core values for determining how we value and use nature. The human right to a clean and healthy environment for all, *including future generations*, is respected. Full and effective participation of the most vulnerable and marginalized groups, including youth, women, and indigenous peoples, are given greater attention as well as meaningful and non-tokenistic spaces in decision making. This recognizes the important role they play in the conservation of biodiversity. The value of indigenous and local knowledge to a healthy planet is also recognized and respected. Young people are able to hold environmentally destructive individuals, companies, and governments accountable through formal legislative mechanisms that have been put in place for them to fight for their rights and the rights of future generations to a healthy future. This has helped in achieving greater transparency and accountability in governance. As a result, it is a decentralized and citizen-led world sustained by an empowered and informed citizenry. People embrace and celebrate diversity and the very things that make cultures and places unique. There is also less of a divide between rich and poor because all are living within a safe operating space for nature, and this has meant a drastic reduction in consumption of previously defined 'luxury goods'.

Communities are connected and value collaboration, which is manifested in the ways we come up with nature-based solutions. These processes are facilitated and made easier through technology and applications that, for example, gather data on worldwide flora and fauna and monitor our environment through citizen science. These have not only got people interested in nature again but to some extent have also helped to bridge the 'disconnect' from nature that often comes with the growing use of technology, especially in cities where there is less nature to be found. With the increased access to technology also comes the ease of communication. Relevant information is able to reach more people so that they can make more informed decisions and actions. However, to ensure the privacy and the management of other associated risks, there are safeguards as well.

This world has transitioned into a *circular economy*, which relies on fair trade practices. People consume things sustainably, mindfully, and responsibly. Goods largely come directly from local producers, sustainable clothing is the norm, and unsustainable options are phased out. There would be ways and technology available to encourage repair rather than replacement. Imagine having a 'library' for objects- wherein it would be possible and widely practised to simply borrow things from a common place rather than buying new products, thus reducing waste. More and more, products would be made with sustainability, durability, and re-usability in mind.

In this future, nature is thriving. Cities are greener with the use of green energy, technology, infrastructure, and designed to decrease the impact of cities on the environment. Green spaces are valued and maintained. Agroecological communal farming in urban areas is practised widely and has helped in achieving *food sovereignty*. These self-governing lands are also connected with each other. It is envisioned that increasing capacity to grow food locally could reduce the negative impacts of long-distance transport, waste from packaging, and unsustainable energy sources. This has helped in blurring the dichotomy between rural and urban areas.

People feel good about doing good and are happier because of it. People act, produce and consume in consideration of other peoples' needs and the well-being of nature. Rather than money, power, economic gain, and development being the primary goals, this vision would instead value happiness, well-being, and the integrity of our life-support system, which is biodiversity. In this world, conserving biodiversity is envisioned to be ingrained in our way of life.

3.1.4. Iandé Etama (rural landscapes)

Iandé Etama means 'our land' in *Tupi*, an indigenous Brazilian language. In this vision, the rural landscapes are no longer synonymous with poverty, degradation and hardship, but are now centers of advancement and nature-human harmony. As basic human needs are taken care of easily, the countryside has repopulated due to reverse migration, and there is neither no longer financial disparity nor stigma attached to living in town or country. People live comfortably, with excess consumerism replaced by high quality, sustainable luxuries and ready access to travel opportunities. *High-quality education* is easily available to all. Using hi-tech tools like holograms, you can have a life-like projection of a teacher from any part of the world to teach you and this has helped to spread a global appreciation of diverse cultures.

Goods move freely and easily, meaning that land planning can be conducted at an international level, with regions designated to growing and producing a handful of products for which they are most suited. Networks of automated electric vehicles carry people from one side of the world to another in hours, using

the local community-run power grids. Enough clean renewable energy is generated from them to meet all energy demands round the year. We have successfully phased out fossil fuels. Alongside the increased speed of travel, *people readily mix at a global scale*, and racial segregation has become a thing of the past. The community has the voice and power in this future to take decisions regarding development and natural resources management. Everyone has an equal representation as discrimination is no longer accepted, or ignored.

Technological advancement has made our lives easier and more efficient with robots doing all the labour-intensive work. People do not have to work as much as they do now and have more free time to spend on travelling, looking after themselves, or exploring something new. The efficiency in agricultural production means that large natural areas, including areas of high endemism, can be spared as protected areas, with additional buffer zones and connectivity corridors given over to recreational use or less intensive production, such as low-intensity cattle grazing or shade-grown coffee. Private property and land-ownership still underpin the land tenure system, however, community co-operatives are now dominant due to the support given by the government. The community is responsible for taking care of the land that they share and use. Facilitated by *good governance and strong land-sharing policies* that ensure technical and technological expertise, there are no fights for land and everyone has equal access to it. Our land is more connected and productive. This has helped to bring biodiversity back from the brink of another mass extinction and into our backyards. Conservation of species and ecosystems is greatly improved at global and local scales; as a result, the extinction rate has declined to its lowest in 5,000 years. Our environment is much cleaner and healthier to live in.

This world follows a *sharing-based economy* and exchange is the new way to get things. Attitudes to production and economics have changed from supporting competition and growth to *collaboration* for increased efficiency. The wealth of resources available from this economic model means that people no longer compete with each other, cultural boundaries are less important, and aggressive nationalism is no longer accepted. Financial security from the new economic model and a sustainable lifestyle derived from cultural and lifestyle changes have helped in achieving nature to be viewed as a vital part of the community to celebrate and be proud of.

3.2. Comparison of visions across themes

All the visions developed in the workshop aimed to reach sustainable and equitable societies. Although they were envisioned independently from each other and using different seeds, all of them had certain commonalities between them, yet in certain aspects, they were different. We identified 18 general themes or key points related to socio-economic, political and environmental sectors from analysing each vision (Table 3, See Table S2 in the appendix for a more detailed version). The relevance of some of the themes was partly related to the design of the visioning exercise, which was built around seeds focusing on a combination of technological, social, environmental, economic and political aspects.

All the four visions were based on the principle of a different economic paradigm to what we experience now. Economic growth is exchanged for economies that are driven by common values of respecting nature's limits and collective interest. A fundamental shift from consumerism to post-consumerism has led to people making a conscious choice for sustainable and responsible options. Communities believe in sharing, exchanging, recycling or reusing to minimize consumption and thus waste. However, these goals are achieved in different ways in the various visions.

There is also a close connection between people and nature in all four visions, which is facilitated by the revival of biodiversity and green spaces (cleaner oceans in Anthropocene 2.0; restored forests in Rural Transformers; urban green spaces in Econetlands; endemic area protected under land sparing scheme in Iandé Etama), technology (technology has freed up more time for people to connect with nature in Iandé Etama and Anthropocene 2.0; citizen science apps in Econetlands), shift in values (protecting nature rather than exploiting it, more towards ecocentrism in all four) and education (Anthropocene 2.0, Rural Transformers and Iandé Etama).

Technology is central to all the visions, but it plays a different role in each of them. There were notable differences related to the type of technology (blockchain, virtual reality, artificial intelligence, drones, citizen science apps, self-driving cars, robots and biotechnology) used under different contexts to monitor biodiversity, produce food, manage waste, restore ecosystems, improve education or share knowledge and information. All the groups also envisioned the application of green technology, green infrastructures, nature-based solutions or renewable energy for cleaner environments, and development is no longer based on the exploitation of natural resources (renewable energy in Anthropocene 2.0 and Iandé Etama; Green energy and infrastructure in Econetlands; lab-grown meat and modified plastic-eating bacteria in Rural Transformers). Technology is also largely responsible for enabling people to enjoy more free time (especially in Iandé Etama and Anthropocene 2.0), which allows them not only to reconnect with each other and enjoy what it means to be human but also to connect with the environment.

On the other hand, food production was differently envisioned under each of the four visions. Some visions were focused on collaborative farming and local production distributed in a more equitable and accessible way (Anthropocene 2.0 and Econetlands) while other creative visions suggested that technology could be a revolutionary innovation to lead positive changes in agriculture (Rural Transformers and Iandé Etama). In Anthropocene 2.0 and Econetlands, local production of food is mainly driven by the aim of making urban centers self-sufficient in food and reducing the cost of transport and distance, and waste. Econetlands was also the only group to acknowledge agroecological communal farms for sustainable and healthy food production. In Iandé Etama, efficiency of agricultural lands has been increased by technology, especially robots, which do most of the labour work such that some amount of land can be spared even with intensive cultivation. In Rural Transformers, the revolutionary innovation of lab-grown meat has completely replaced animal meat as a major source of protein, leading to a decline in livestock rearing.

While Rural Transformers suggested bacteria for degrading plastic, the other visions saw plastic as 'something from the past', with no single-use plastic in the world any more. This implies a fundamental difference in the management of waste by Rural Transformers to the other groups, allowing at some point the production of goods made from plastic with the possibility of using technology for degradation and possible re-use of this material. Additionally, the group proposes energy generation from the process of plastic degradation by bacteria, highlighting that all of the life cycle of plastic goods is used for the benefit of society.

The recognition of traditional knowledge and the active participation of the most vulnerable and marginalised groups in decision making is emphasised by Econetlands. This vision differs from the other groups in the nature-society interactions and in participatory community development themes because inclusivity is explicitly taken into consideration. However, inclusivity is assumed in all of the visions regarding broader aspects, such as societal organisation. Econetlands emphasised communal and cooperative land tenancy arrangements, conventional private lands were envisioned by Iandé Etama. The other groups did not reference land tenancy, however, the communal and sharing economy is assumed for all of the goods, which might also include land.

Finally, human health and cultural heritage were topics described more in-depth only by Anthropocene 2.0 and Econetlands, respectively. All of the themes, as envisioned by each group, is shown in Table 3.

4. Discussion

4.1. Archetypes

We contextualized the four visions within the scenario archetypes used in the IPBES regional assessment process to synthesise and harmonise the analysis of existing regional and global scenarios (See Sitas et al. 2019). As this was such an important organising principle for IPBES scenarios work, it is important to see what additional contributions this visioning process based on the Nature Futures Framework can make for future assessments. Since all the visions developed at the workshop were framed as 'desirable' in focusing solely on the positive aspects of reaching sustainable and equitable societies, the scenario archetypes relevant for these visions are particularly Regional Sustainability and Global Sustainable Development (IPBES 2016). Regional Sustainability envisions a regionalised world with a shift towards local and regional decision-making motivated by increasingly environmentally aware citizens, focusing on welfare, equality and environmental protections through local solutions. In contrast, Global Sustainable Development envisions a globalised world steered by policy-makers proactive in environmental issues through high levels of regulation and strong multi-level governance, behavioural change through education and technological change.

Two of the Youth Workshop visions, Anthropocene 2.0 and Econetlands, closely resembled the Regional Sustainability archetype, emphasising changes in values, localised decision-making and local food production. However, the archetype assumes slow technological development, whilst Anthropocene 2.0 and Econetlands envisage highly technologically sophisticated societies, emphasising the use of virtual reality and data-driven approaches to sustain sharing economies. While bottom-up and top-down technology-driven innovation is an important part of the solutions mix of the future, it is also important to reflect that it can also generate undesired sustainability outcomes, such as further social inequalities (e.g. the digital divide). The use and implications of new-age technologies for social innovation are still understudied, and it is critical to ensure these technologies are upholding the principles of fairness, accountability, and transparency (Gupta et al. 2019). In addition, these discussions could be nuanced with philosophical reflections from currents such as accelerationism (Sharzer 2018). In contrast, Regional Sustainability archetype focuses on environmentally aware citizens and higher intrinsic and relational values of nature, while the Anthropocene 2.0 and Econetlands imagine future communities who understand sustainability and environmental harmony as key contributors to happiness and equity, replacing GDP as measures of societal success. Already there are promising proposals for

alternative measures of societal progress, which consider more than just turnover of goods and services in a given economy, such as the Genuine Progress Indicator (Costanza et al. 2014) and happiness index, reported in the annual World Happiness Report of the United Nations (Helliwell et al. 2019).

The two remaining visions, Iandé Etama and Rural Transformers- seem to be similar to the Global Sustainable Development archetype. They emphasise strong multi-level governance, high levels of regulation, a global shift away from meat consumption and a focus on renewable energy production. The biggest difference lies in the limitations of these changes. Whilst the archetype discusses 'moderate economic development' and 'low availability of luxury goods', the Youth Workshop visions do not problematise the access to resources that would be required to maintain access to renewable energy, and instead focus on how technologies, such as plastic degrading bacteria, can help to overcome these constraints through recycling and reuse- a concept that is central to all the visions. These worlds have an increased emphasis on regulations creating greater land-use and food production efficiencies, highlighted by Iandé Etama imagining globally organised farming and Rural Transformers not having livestock production.

The interesting role that technological advancement plays in all the visions is an important addition to the standard archetypes approach. The only explicit reference to a technological future world is in the 'Technogarden' description of the Millennium Ecosystem Assessment. It describes a 'globally connected world, relying strongly on environmentally sound technology, using highly managed, often engineered, ecosystems to deliver ecosystem services, and taking a proactive approach in the management of ecosystems in an effort to avoid problems' (MEA 2005).

These youth visions go substantially further in recognising the positive role that technology could play in creating a more sustainable future. However, there is also scope for a critical analysis of these to ensure that they are not purely perceived as techno-optimist, but that they carry a much wider range of values for nature, especially recognising relational value for nature (see Chan et al. 2016; West et al. 2018). It would be interesting to have further research on more diverse groups of millennials to see whether technology plays a significant role in their visions of more sustainable futures. Research has shown that millennials are much more connected to and comfortable with technology than previous generations (Keene and Handrich 2010; Serres 2014; Circella et al. 2016). This could potentially be a hallmark for how the youth envision the future, how technology often plays a big role in their visions and how to overcome the sustainability challenges associated with it. However, it is important to emphasise that none of the visions advocates for an ecomodernist approach by which 'rapid technological progress presents the sole means by which to avoid dangerous climate change and ensure human welfare' (Isenhour 2016). These are critical challenges to sustainable development underpinning current pledges for a new Sustainable Development Goal to ensure that the transformative power of the digital age truly supports people, planet, prosperity and peace (see Luers 2020; FutureEarth 2020). Furthermore, rather than advocating for a state-directed innovation system to provide global public goods within the realms of a capitalist economy that in essence further separates humans from nature (Symons and Karlsson 2018), the visions explicitly deal with alternative economic systems, engaged citizenship and diverse values for nature.

4.2. Linking youth perspectives to leverage points

The starting seeds (Table 2) in each vision included a range of leverage points and later in the process, these translated into a set of more fundamental leverage points at the heart of each vision (Table 4). The seeds included proposals on the structure of flows and stocks of materials and information as well as deeper aspects, such as improving the self-organisation of the system, changes in legal rules and regulations and, indirectly, changes in economic and cultural paradigms. Through the interaction of the seeds and the participants during the visioning process, the resultant visions also centre around key leverage points that relate directly to ongoing debates in the sustainability literature on what pathways and interventions are required to achieve a better future for people and the planet (Table 4). Although each of the visions started with a group who had an affinity for one part of the triangle, all of the visions ended up acknowledging diverse values for nature. This could be attributed to the participants themselves having diverse values for nature. This would make sense as they were pre-selected to participate in the workshop because of their commitment to nature and biodiversity conservation. However, using the triangle as a starting point may also have triggered the participants to think more broadly about diverse nature values. Further research and more case studies are required in order to analyse this more definitively.

Of the deeper leverage points in each vision, core components included the need for alternative economies and new metrics that recognise well-being and happiness, moving beyond simply economic growth, and proposing a post-monetary economy. These suggestions echo other broader conversations in the literature and public, such as the doughnut economics model, or genuine progress indicator, inclusive wealth index, and others (Costanza et al. 2014; Polasky et al. 2015; Ede 2016; Raworth 2017). Some of this thinking

Table 4. Visions and their key leverage points as they relate to ongoing discussions and their position on the triangle.

Vision			
Name	Position on the triangle	Theme	Key leverage points
Anthropocene 2.0	Middle of the triangle	Coastal systems	Technology used to enable a circular and solidarity economy Behaviour change underpinned by optimised production and consumption New metrics, e.g. Happiness index
Econetlands	Nature as Culture; Middle of the Triangle	Cities	Inclusive governance and full participation of all citizens, particularly ensuring effective participation of marginalised groups including indigenous peoples, women, and youth Intergenerational justice spearheaded by youth environmental movements Sharing economy premised on durability rather than growth and is mainly local
Rural Transformers	Nature for Society	Rural landscapes	Regenerative economy and post-monetary society Highly technological world, but technology deployed to foster human-nature relationships
Iandé Etama	Nature for Nature	Rural landscapes	Land sharing- sparing continuum: the agricultural efficiency leaves space for nature to thrive, but people also return to rural areas and live close to nature Ecomodernist approach to enable access to goods and experiences (Robots, VR teaching) Decoupled economy- not growth and competition, but collaboration for increased efficiency

talks directly to ongoing debates about what kind of economy is preferable for a sustainable future with some recent publications suggesting degrowth and other alternative economic models are critical in order to halt biodiversity losses (Hinton and Maclurcan 2017; D'Alessandro et al. 2020; Otero et al. 2020). Other deep leverages revolved around new governance structures and institutions, tackling issues such as intergenerational justice (Johnston et al. 2020) and inclusive planning and management (Fischer et al. 2014). These leverages would change property rights laws that currently allow large corporations to own much of the world's natural resources, and therefore, hinder the cooperation needed to address sustainability challenges.

The hyper-connectivity proposed in some of the visions is currently manifesting in various forms facilitated by the internet and other platforms and is already affecting different cultures and languages in ways that may not be obvious right now. Therefore, it is an open question whether it would be possible to have connectivity as global citizens and also maintain local biocultural diversity (Pereira et al. 2018; Raudsepp-Hearne et al. 2019). The complex analysis of telecoupling- for example how demand in one part of the world drives environmental degradation in another part- is a cutting-edge area of sustainability science research (Liu et al. 2013). Highlighting this in the visions opens this up as a critical area for science and policy to engage.

All of the visions offered alternative patterns of development with technology as central in all of them but manifested in different ways. In Anthropocene 2.0 and Econetlands, technology was generally used to drive circular and solidarity economies, whereas, in Rural Transformers it was used to foster closer human-nature connections (Kahn et al. 2009). In contrast, Iandé Etama tended towards a more eco-modernist approach where technology was deployed to enable better access to resources and experiences but was decoupled from natural resource use.

One key question with any new suggestion for policy or innovation or change is how it is going to be implemented. Various modes of collaboration exist, from which lessons can be drawn. For example, the recent collaborative process to enable the IPBES and IPCC communities to work together potentially provides an opportunity to develop more actionable outputs for governments to take up. Such discussions are also relevant in the ongoing processes under the Convention on Biological Diversity (CBD), particularly in the development of the Post-2020 global biodiversity framework, which is set to outline global action targets to address biodiversity loss for the next decades as a follow up to the Strategic Plan for Biodiversity 2011–2020. Other examples include the roles of environmental movements in driving social innovation in the food system (Pereira et al. 2019a; Stringer et al. 2020).

More work is needed to develop pathways to identify how these visions could be enabled, and what trade-offs and conflicts might arise. For example, there is a growing literature emphasising the 'dark side' of transformation where the risks associated with transformation are highlighted, such as not taking into account power dynamics and putting the burden of change on the most vulnerable (Blythe et al. 2018). This can be true of all transformations, whether innovations are designed for incremental or radical change (E.g. Szekely and Strebel 2013), and is ever more important to consider when referencing deliberate transformations towards sustainability (See O'Brien 2012; Moore et al. 2014: Iwaniec et al. 2019 for more on deliberate transformations). It is not in the scope of this paper to analyse the pathways of getting to the visions described by the four groups, however, it is important to emphasise that the 'how' to get somewhere is as important as the 'what' towards which we aim to transform. A deeper analysis of the pathways, highlighting what would actually need to change to get to these futures, their potential conflicts and repercussions, is an important next step in using these visions to open up discussions about enabling a diversity of desirable futures for the planet.

4.3. Limitations, learnings and future perspectives

One of the limiting aspects to highlight is that while the prominence of themes (e.g. technology) in the youth visions illustrates issues of importance for the community of youth change-makers, this may also have been influenced by the visioning method, which predetermined the topics to discuss. In this study, the visioning exercise was framed around the Nature Futures Framework and set up around three seeds. To a certain extent, these topics became central to the resulting visions and were given more attention than the original group themes. This could have resulted from the constraints imposed on the groups to ensure that they discussed across the technological, social-environmental and economic-political domains. And even though each group has more affinity to one value of nature, all four visions held a combination of value perspectives. Despite this, the approach was designed as a means through which to create participant buy-in to the process, whilst still generating positive nature future visions within time constraints.

This methodological approach allowed the workshop participants to focus and discuss certain aspects of the positive futures more in-depth, but it did lead the final narratives in a particular direction. With not enough focus given on capturing tensions and feedbacks in many scenario approaches (van Vuuren et al. 2012; Raudsepp-Hearne et al. 2019; Hamann et al. 2020), we attempted to include them in this exercise. However, the participants found the process challenging and the given time frame insufficient to capture feedback and tensions in the visions. The seeds approach is highly adaptable to work across different time frames (from 1day to a 5-day process), but this does mean the resulting visions will have slightly different outcomes. We acknowledge these methodological differences and do not assume that all resulting visions are directly comparable.

More work is also required to see how much of an influence the NFF has in framing the group discussions, whether it is useful as a heuristic device for analysing diverse perspectives and for getting participants to reflect on the multiple values of nature that the participants hold. Further adaptation of the methods is important to be able to see how to ensure a genuine collection of positive nature futures can be generated from participatory processes at the global level. The more case studies there are that make use of the seeds approach and NFF, and explicitly employ different ways of choosing the initial seeds will allow for a more rigorous interpretation of the resulting visions (See Pereira et al. 2020). Also, we suggest that more studies following the seeds approach also focus on including discussions on feedback and tensions that might arise from the interaction in the imagined future world.

Another limitation comes from the composition of the participants in terms of regional and gender balance, sufficient representation of knowledge systems apart from science, and their interests and expertise. We acknowledge that achieving better representation in terms of these aspects would have produced richer visions and discussions that reflect more realities. The themes represented in the visions are due to the interests and expertise of the workshop participants and uncovering alternative deep leverages could be related to disciplines not represented in this group of participants; or even due to limited time available to explore the deeper implications of each vision, especially the feedbacks. Future regional workshops could be developed in order to address more local perspectives in order to develop more representative regional and global futures. Broader participation of sectors and disciplines should be sought and encouraged, such as by actively involving youth from indigenous peoples and local communities, social movements, policy, varied academic fields, and grass-root organisations and, as is often the case for such processes, more time can be allocated to ensure a deeper discussion.

Finally, it is important to emphasise that this work is in no way meant to represent the diverse voices of the global youth. Rather, it is meant as a starting point for more such initiatives to take place, maybe led by the participants themselves in their respective communities. However, there is learning from this workshop on how to invest in participatory processes that tap into the vast

potential of young people, including researchers. The process in this workshop was unique in that the facilitators and participants were all classified as millennials (Generation Y). This means that the process was completely youth-led and almost all the author team of this paper are early career researchers and practitioners. Although it seems that up to now, there has been little space for the voices of the youth to be clearly articulated in intergovernmental processes, initiatives for early career researchers in global sustainability programs has recently become one way to engage youth and to connect their visions with scientific assessments (Lim et al. 2017). However, Jørgensen et al. (2019) argue that some initiatives so far have had an emphasis on youth, but not made an explicit connection with the increasingly organised early career researcher community as a whole. This is a challenge to be addressed by the scientific community in order to contribute to a sustainable future for the next generations.

A key finding of this process was that engaging early career professionals in participatory visioning exercises is of extreme relevance in the political-scientific context of coproduction of science and solutions. With growing exposure to a diverse world along with a familiarity with emerging communication and engagement technologies, young voices can bring perspectives that might not always be captured by senior scientists (Lambini and Heubach 2017; Hackenburg et al. 2019). Through this work we have made a first step towards including youth voices in envisioning a better world, which also feeds into the ongoing IPBES work on scenarios and modelling. Imagining more positive futures and steering institutions to pursue them is a powerful tool to engage youth in shaping the future of their societies (Nilsson et al. 2019). Geographical and gender balance, the inclusion of a broad range of disciplines, world-views, and knowledge systems, as well as representation from indigenous peoples and local communities, are increasingly recognized as crucial in sustainability initiatives (Turnhout et al. 2012; Tengö et al. 2014; Lim et al. 2017). Future vision building initiatives should aspire to reach such representation. In this sense, it is urgent to identify the absent youth voices and make sure that their future visions are represented (Jørgensen et al. 2019).

IPBES is making sincere efforts in bridging the gap between different stakeholders and world-views and engaging them through its increasingly inclusive and participatory initiatives with a focus on early-career scientists (the youth with scientific knowledge) (Díaz-Reviriego et al. 2019). By learning from this first Youth workshop, more diverse youth can be reached out through similar workshops in other regions of the world under the capacity building program of IPBES. However, these workshops definitely need to be tailored to suit the diversity (in terms of demography, knowledge, values and expertise) to maximise their impact and outcomes. It is critical that as many diverse youth visions as possible are incorporated in the future generation of scenarios and main decision-making processes to benefit.

5. Conclusion

The advent of the Anthropocene- the age in which humans have become the dominant force of change on the planet- brings with it the challenge of how to imagine what a radically different, more just, equitable and sustainable world could be (Bennett et al. 2016). Looking 100 years ahead is not an easy task, and especially as millennials, it looks quite bleak. Given the rise in far-right political movements that do not have equity and sustainability concerns at the heart of their manifestos (Muradian and Pascual 2020), this is an important time for the youth to be able to counter such political path dependencies with more hopeful alternatives. However, the youth are often forgotten in terms of involvement in both shaping the narrative and participating in the solutions for building a more desirable future. In these visions, we have laid out a set of possible visions of the future- we know that none of them will actually come about, but by engaging in such a creative exercise, it is possible to chart the course for a better future. These stories that we draw on in our time of need will determine the direction that we take (Evans 2017). We, therefore, need to imagine a better set of futures for the people and the planet so that we can affect better choices in the present.

Decisions being made in global environmental governance arenas such as the UNFCCC and the CBD, as well as all other levels of governance, need to take the voices of young people very seriously and actively include those whose chance at a safe, clean, healthy, and sustainable future with a good quality of life rests largely in the hands of decision-makers of today. As the 16-year-old Swedish climate change activist Greta Thunberg addressed the United Nations in September 2019:

"You are failing us. But young people are starting to understand your betrayal. The eyes of all future generations are upon you. And if you choose to fail us, I say: We will never forgive you.

We will not let you get away with this. Right here, right now is where we draw the line. The world is waking up. And change is coming, whether you like it or not."

We offer these visions as a starting point for opening up the conversation about what desirable futures might look like from the perspective of young people. We urge others to undertake their own visioning processes to enrich the set of diverse stories that the youth is able to tell about the future that they want.

These visions are not meant to be endpoints, and we welcome further critical engagement with their content as humanity tries to chart a path to a better future for people and the planet.

Note

1. https://www.designdeconversas.com.br).

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